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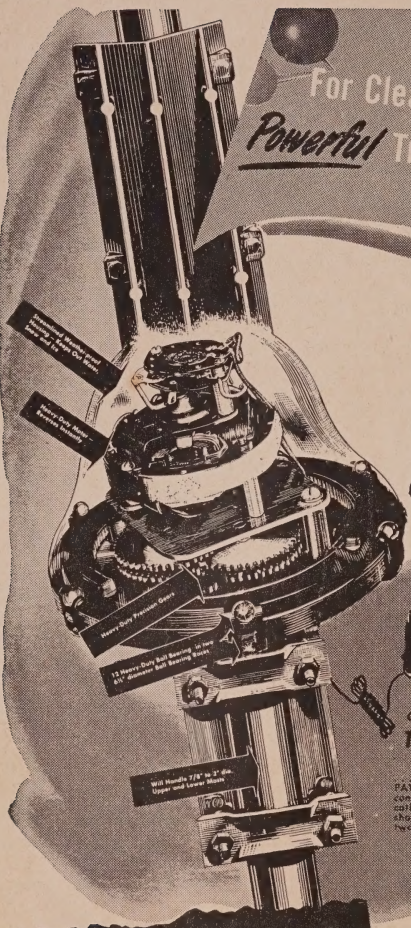

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TUBELESS POWER SUPPLIES

The radio replacement-type selenium rectifier has changed completely the size and shape of transformerless power supplies. Radio, electronic, and television designers and technicians have been quick to embrace the advantages of this simple 2-terminal rectifier unit.

One of the chief advantages of the selenium rectifier is its comparatively small size. In any current rating, the selenium rectifier occupies only a fraction of the volume taken by a tube with comparable ratings. Another important advantage is cooler operation than is possible with rectifier tubes. This is due largely to elimination of the tube filament or heater which requires appreciable operating wattage and therefore radiates considerable heat. (The heater of a 25Z5 tube consumes 7½ watts, a 35Z5 5¼ watts, and a 50Y6 7½ watts). Because the power-consuming filament is eliminated, the selenium rectifier also is more economical, power-wise, to operate. It is a simple device to wire into a circuit, since it has only two terminals. Still other advantages of the selenium rectifier are lightness of weight, easy adaptability to voltage multiplier circuits, relatively low cost, ease of installation in crowded quarters, and low internal voltage drop.

Miniature selenium rectifiers currently are available in 50-, 65-, 75-, 100-, 150-, 200-, 250-, 300-, 350-, 400-, 500-, and 1000-milliampere sizes. These figures designate the **maximum** d. c. output load current of the rectifiers as read with a standard milliammeter.

While the advantages of the selenium rectifier undoubtedly have been realized chiefly in transformerless power supplies, these units may be employed (in series-connected pairs or trios) also in standard transformer-type power supplies when replacement of the conventional tubes is desirable. Conventional selenium rectifier circuits are (1) the simple line rectifier, and (2) voltage multiplier circuits. Other circuits less frequently used include bridge and full-wave tapped-resistor types.

The various circuits and their practical characteristics will be discussed separately in the following paragraphs.

Half-Wave Rectifier

The simplest single-phase selenium power supply is the half-wave rectifier shown in Figure 1. This circuit is known also by the term **line rectifier** derived from the fact that it is

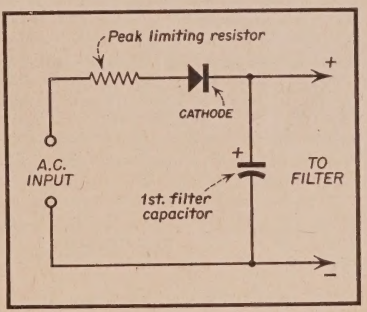

Fig. 1. Half-Wave Rectifier.

operated directly from the power line, and is the type of power supply always used in a. c. - d. c. radio receivers.

Since the rectifier in this circuit conducts only when the upper AC INPUT terminal is positive, the filter capacitor is charged only once during each supply voltage cycle. The ripple voltage component in the d. c. output accordingly has a frequency equal to the supply voltage frequency. For this reason, the simple half-wave circuit requires somewhat more filtration than circuits in which the capacitor is charged during each half-cycle of sup-

ply voltage and the ripple frequency is higher than that of the supply.

When the rectifier is conducting, on the positive half-cycle of supply voltage, charging current flows into the filter capacitor. The peak value of this current depends largely upon the capacitance, being highest for large capacitances. In order to limit the peak current to a safe value which will not damage the rectifier unit, it becomes necessary to connect a peak limiting resistor of appropriate size in series with the rectifier and the supply voltage, as shown in Figures 1 to 5. Current flowing through this resistor produces a voltage drop across the resistor. High currents will require less peak limiting resistance to give a given voltage (I x R) drop. The value of the peak limiting resistor accordingly is smaller for the higher-current rectifiers. It will vary from 4 or 5 ohms for 1000-milliampere rectifiers to about 50 ohms for the 50-ma. size. The required wattage of the peak limiting resistor varies from 2½ watts for the 50-ma. rectifier to 5 watts for the 1000-ma. size. In the interest of good safety factor, the resistor should be chosen to have at least twice the indicated power rating. The exact ohmic value of peak limiting resistors for all selenium rectifiers may be obtained from the rectifier manufacturer's literature.

An important characteristic of any power supply is **voltage regulation.** This refers to the amount by which the d. c. output voltage drops from its no-load terminal value to its value at full rated output current. Voltage regulation is expressed as a percentage and is equal numerically to:

$$(1) \quad \% \text{ Regulation} = \frac{100\ E_1 - E_2}{E_2}$$

Where E_1 is the no-load terminal d. c. voltage, and

E_2, the d. c. output voltage at full current drain

Voltage regulation is best (that is, of low percentage) when the first filter capacitance is high.

The following data show voltage regulation figures for common selenium rectifiers and various conventional capacitances used in the circuit of Figure 1.

50-ma. Rectifier	
20 ufd.	23.5%
40 ufd.	15.3%
65-ma. Rectifier	
20 ufd.	25%
40 ufd.	20%
75-ma. Rectifier	
20 ufd.	23.5%
40 ufd.	17%
100 ufd.	14.5%
100-ma. Rectifier	
20 ufd.	37.4%
40 ufd.	24.4%
100 ufd.	21%
150-ma. Rectifier	
20 ufd.	53%
40 ufd.	25.6%
100 ufd.	18.9%
200-ma. Rectifier	
20 ufd.	68.8%
40 ufd.	28.7%
100 ufd.	16.3%
250-ma. Rectifier	
100 ufd.	21.2%
400-ma. Rectifier	
100 ufd.	29.6%
200 ufd.	22.7%
500-ma. Rectifier	
100 ufd.	36.4%
200 ufd.	27.8%

In the half-wave circuit, the second filter capacitor should have the same capacitance value as the first. Both must have a minimum d. c. working voltage rating equal to 1.41 times the r. m. s. value of the a. c. supply voltage. The filter choke should have as low a d. c. resistance as practicable. Where a moderate amount of ripple

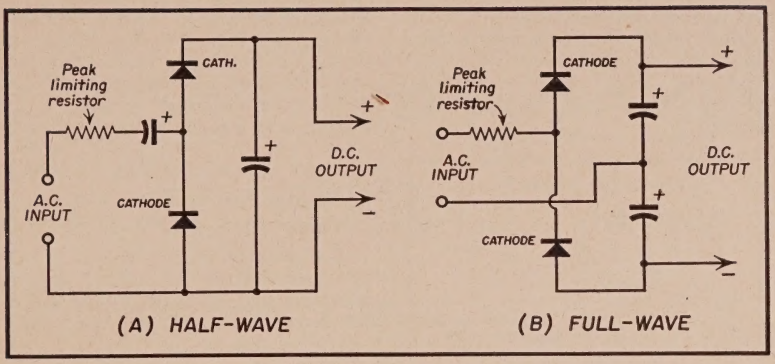

Fig. 2. Voltage Doublers.

can be tolerated, as in audio power output stages, a resistor may be substituted for the usual iron-core choke. The value of this resistance may be between 100 and 500 ohms, depending upon the amount of voltage drop which can be tolerated in this component. When very low ripple values are required, several cascaded identical filter sections must be employed with the simple half-wave rectifier type of power supply.

Voltage Doubler

The voltage doubler is the most frequently used transformerless voltage multiplier circuit. The no-load d. c. terminal output voltage of this class of circuit is 2.82 times the r. m. s. value of the a. c. supply voltage. Thus, a voltage doubler operated from a 115-volt a. c. power line will deliver a no-load d. c. output voltage of 324 volts. As output current is drawn, the voltage will fall to a value dependent upon the voltage regulation of the circuit.

Two types of voltage doubler circuits are in common use. The **half-wave doubler** is shown in Figure 2 (A); the **full-wave doubler** in Figure 2 (B). The half-wave circuit has the advantage that one side of the a. c. supply is common with the negative d. c. output terminal. In the full-wave circuit, the negative d. c. terminal cannot be "grounded" to the a. c. supply and this often gives rise to hum difficulties in radio receivers or high-gain amplifiers powered by the voltage doubler. For this reason, the half-wave doubler is the circuit most frequently used in tubeless, transformerless doubler-type power supplies. The half-wave doubler has the disadvantages, however, that its voltage regulation is not as good as that of the full-wave doubler, and it is somewhat harder to filter completely because of its higher ripple output. The full-wave circuit has lower ripple percentage because of its higher ripple frequency and also affords better regulation.

Two identical rectifiers are required in each voltage doubler circuit. Capacitor and rectifier polarity must be followed, as shown in Figure 2. As in the case of the simple half-wave rectifier, voltage regulation of the doubler circuit is improved by using high capacitances. The following data give regulation percentages which may be ob-

tained with the two sizes of selenium rectifiers most frequently used in half-wave voltage doubler circuits. The regulation figures are given for each of the capacitances commonly employed.

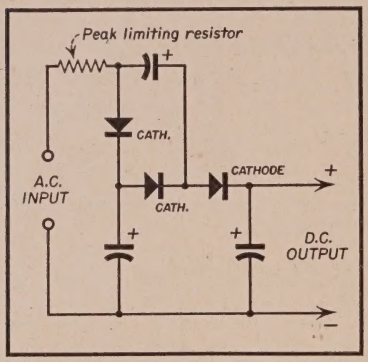

Fig. 3. Voltage Tripler.

100-ma. Rectifier

20 ufd. each capacitor	53%
40 ufd. each capacitor	29.8%
100 ufd. each capacitor	22.3%

200-ma. Rectifier

40 ufd. each capacitor	56%
100 ufd. each capacitor	42%

Voltage Tripler

The voltage tripler (See Figure 3) is a form of transformerless voltage multiplier which delivers a no-load d. c. terminal output voltage equal to 4.24 times the r. m. s. value of the a. c. supply voltage. Thus, a voltage tripler operated from a 115-volt a. c. power line will deliver a no-load d. c. output voltage of 487.6 volts. As output current is drawn, the voltage will fall to a value dependent upon the voltage regulation of the circuit.

Three identical rectifiers and three identical capacitors are employed in the tripler circuit. As in other tubeless, transformerless power supplies, voltage regulation is improved by use of large capacitances. The following data give regulation percentages for two commonly used capacitances and the 200-ma. selenium rectifier, combinations very popular for tripler service.

200-ma. Rectifier

40 ufd. each capacitor	40.5%
100 ufd. each capacitor	27.6%

The voltage tripler circuit is of particular interest as a power supply for plate and screen voltages in the low-level stages of reduced-weight television receivers.

Voltage Quadrupler

The voltage quadrupler circuit (See Figure 4) is especially useful when a d. c. voltage higher than ordinary must be obtained from a transformerless power supply. Typical applications are in low-powered radio transmitters, insulation testers, and miscellaneous electronic control equipment.

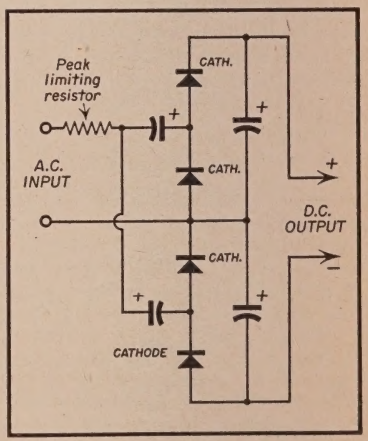

Fig. 4. Voltage Quadrupler.

The voltage quadrupler, which essentially is two doublers in series, will deliver a no-load d. c. terminal output

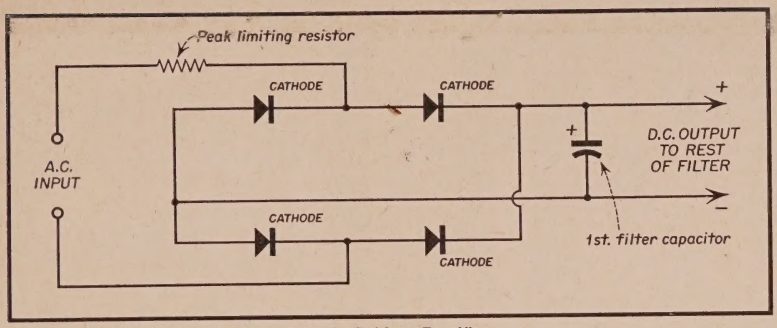

Fig. 5. Bridge Rectifier.

voltage equal to 5.65 times the r. m. s. value of the a. c. supply voltage. Thus, a voltage quadrupler operated from a 115-volt a. c. power line will deliver a no-load d. c. output voltage of 650 volts. As output current is drawn, the voltage will fall to a value dependent upon the voltage regulation of the circuit.

Four identical rectifiers and four identical capacitors are required in the quadrupler circuit. Voltage regulation is improved by use of large capacitances. The following data give regulation percentages for the two commonly used capacitances in combination with the 200-milliampere selenium rectifier.

200-ma. Rectifier

40 ufd. each capacitor	89%
100 ufd. each capacitor	37.4%

Bridge Rectifier

A full-wave bridge circuit employing selenium rectifiers is shown in Figure 5. This circuit is useful for obtaining full-wave rectification when a center-tapped transformer cannot be used.

The voltage regulation characteristics of this circuit are similar to those given for the half-wave rectifier (Figure 1). However, this circuit has the disadvantages that (1) it requires four rectifier units to obtain approximately the same voltage delivered by the single-rectifier half-wave circuit, and (2) the negative d. c. terminal cannot be "grounded" to one side of the a. c. line. The latter condition often gives rise to hum difficulties in sensitive equipment powered by the bridge circuit.

Voltage Variation and Automatic Output Voltage Regulation

The d. c. output voltage of either of the selenium rectifier circuits shown in this article may be varied continuously between zero and maximum by means of a Variac or similar variable transformer connected ahead of the rectifier input terminals. This simple method of output voltage control is simplified by the absence of tube filaments which would have to be powered by a separate transformer in tube-type variable power supply.

Automatic stabilization of the d. c. output voltage may be obtained by means of a single VR-type gaseous regulator tube in the half-wave circuit (Figure 1) or a series combination of VR tubes in the other circuits. The reader is referred to the June 1949 issue of the "C-D Capacitor" for a discussion of VR-type regulator tubes.

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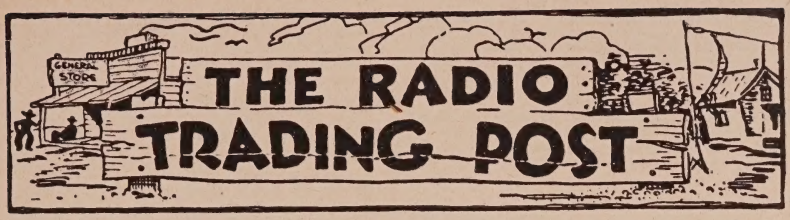

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FOR SALE—BC-221-Q frequency meter, AC powered; including modulation kit. Excellent condition, $50. B. E. Fortner, RR 6, Box 370, Indianapolis 44, Ind.

FOR SALE—Hickok traceometer, model 155, 110 v., 60 and/or 25 Cycle, excell. condition, $75 f.o.b. R. E. Mefford, 1035 S. Plane St., Burlington, Iowa

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TRADE—Complete set of registered Kroydon golf irons (8) model-39, good condition. Want sig. gen. and volt-ohmeter. R. J. Pelt, 928 Bluebird Rd., Augusta, Ga.

FOR SALE—7" Transvision TV with deluxe continuous 12 channel tuner. Ready to operate with all tubes but less high voltage transformer. What is your offer? Lester Shaffer, Box 43, Shrewsbury, Pa.

FOR SALE—Feiler sig. tracing stethoscope model TS-3, used only few hours; DeForest's Radio-TV lessons, 110 lessons complete with answers, both for $25. H. J. Richards, 6716 S. Parnell Ave., Chicago 21, Ill.

WANT—Graduate radio technician desires position as trouble shooter. Some knowledge of TV trouble shooting, 3½ years of Navy experience. Bernard Feldman, 230 W. 101 St., New York 25, N. Y.

FOR SALE—Rider manual No. 18, never used, $14. R. E. Johnson, 3 Washington Pl., Cranford, N. J.

WANT—Riders manual, vol. 14. Please state price and condition. E. A. Grunеich, Buffalo, N. Dak.

WANT—Radio for 1940 Oldsmobile. Used radio acceptable if serviceable. Cort Platt, 5034 Chowen Ave. South, Minneapolis 10, Minn.

FOR SALE—Unused EICO 425K oscilloscope, sweep 15 to 75000 cps. Pushpull amplifiers, sensitivity 0.05 v. per inch, $49.50. Gerarld Esterson, 2922 Norfolk Ave., Baltimore 15, Md.

FOR SALE—Hickock 610 TV generator, $115, guaranteed perfect condition. Vision Tele-Booster model TVX, $15. Buick 1937 model 980534 car radio, overhauled and in good condition, $15. Horace D. Westbrooks, Box 281, Griffin, Georgia.

FOR SALE—Simpson model 260 volt-ohm-milliammeter, open face model, like new, operator's manual and test leads included, $34. Lynn Vandemark, Box 196, Annawan, Illinois.

FOR SALE—NC-57 excellent, $55; Handy Talkie BC-611-A complete in working order with extra tubes, coils, and xtals, $25; Regency FM tuner, $17.50; G.I. Recording Unit, $19. Bill Ewing, 4316 Fairfax Avenue, Dallas 5, Texas.

FOR SALE—Precision E-200-C sig. gen. never been used, complete with SSS handbook. Best offer plus postage. G. A. Galeota, 84 Carvel Ave., Odenton, Maryland.

FOR SALE OR SWAP—CREI Main Course and U.H.F. Techniques, recent and in perfect condition. Michael A. Hart, 87 Sherman Ave., Jersey City 7, N. J.

FOR SALE OR SWAP—Best offer takes them. Rider's Manuals Nos. 2 to 13, almost new condition. Or swap for good VTVM. B. Levinson, 2069 Shore Blvd., Long Island City 5, N. Y.

WANTED—CIRE or other course on radio communications to prepare for FCC exams. Louis T. Le Blond, 107 Southgate St., Worcester, Mass.

FOR SALE—Complete servicing outfit, work bench, tube tester, test oscillator, ac-dc volt-ohm meters, 100 tubes, filter-condensers, etc. Come carry away, $300. John Meek, 5619 Chicago W., Detroit 4, Mich.

WANTED—48-50 Packard custom built radio. James Gilbert, 719 Silver Spring Avenue, Silver Spring, Maryland.

WANTED—In new or excellent condition, recent complete correspondence AM-FM and TV course in theory and servicing, with or without kits. George Grossman, 3425 Gates Place, New York 67, N. Y.

FOR SALE—Complete shop full of modern test equipment at about half wholesale cost. Sprayberry and Nilson correspondence courses. Write for list of prices. H. W. Smith, 503 Walsh St., Austin, Texas.

TRADE—Complete Diesel and Auto Mechanics course, 125 lessons, cost over $100. Want radio in playing condition for '40 Plymouth. Stanley J. Radwanski, 1605 Indiana Ave., Vincennes, Ind.

SWAP—EV-10 Precision VTVM for good tube tester. Harry Choy, 200 MacDonald Ave., San Francisco 24, Calif.

FOR SALE—E-200-C Precision sig. gen. and instruction book, $50; 12" coaxial speaker (dual) 55 to 12,000 C.P.S. tweeter and woofer in 1 unit, $12.50 FOB. John Moeller 1113½ Spruce, Boulder, Colo.

FOR SALE—Universal H-3 16mm sound projector. 2000' capacity, 750 watt lamp, full ac amplifier, 6L6's output, 12" spkr. Robert E. Lee, 263 Harrison St., Nutley 10, New Jersey.

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FOR SALE OR TRADE—Motorola 10 meter mobile transmitter; Gonset converter; misc. parts. Write for list. E. L. Felder, Tylertown, Miss.

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FOR SALE—BC348 converted, with mounting, manual, S meter, noise limiter, audio stages, audio filter stages, 10" speaker with power supply in metal cabinet, 10 meter and broadcast converter. Walter Berke, 378 Alphonse St., Rochester, N. Y.

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FOR SALE—Back issues of Radio News, 1919-1941; Modern Elec., 1909-1913; Radio Craft, 1929-1942; Elec. Experimenter, 1913-1920, and others. Gifford N. Hartwell, 38 Charlemont St., Newton Highlands, Mass.

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FOR SALE—Jewell 199 Analyzer, $25; 2 capacity meters, $5; 2 ohmmeters, $7.50; Dayrad Analyzer, $15. J. M. Gantt, 24 S. Capitol Parkway, Montgomery 7, Ala.

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FOR SALE OR TRADE—Four books: Elements of Elect. by Robinson; Elements of Elect. by Timbie; Math of Applied Elect. by Cooke; Radio Hand Book 9th Edition. Also double V television stack without mast. Want Condenser Analyzer or what have you? William C. Stadtler, 49 Miller Avenue, Brooklyn 7, N. Y.

WANTED—Condenser checker. State year, make, and price. John Moreschi, 560 Main St., Orange, N. J.

TRADE—Electronic Instruments sig. gen., Philco tube checker (1949), Triplett pocket VOM for Riders' Manuals, oscilloscope, Sam's Photo Facts, sweep gen., VTVM, Chanalyst, any part or combination will be considered. R. L. Shenberg, 2243 N. 33rd St., Philadelphia 32, Pa.

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FOR SALE—MB8 megohm bridge 1 megohm to 1000 megohms and 100 megohms to 100,000 megohms operating on 115V 50-60 cycles bridge volts 500V dc. Used but in A-1 condition (minus hinged lid), $25. Henderson Lynn, 200 E. Marshall Rd., Lansdowne, Pa.

FOR SALE OR TRADE—Amplifier with record changer; 2 battery radios; portable radio. E. G. Bartlett, Atlanta, Mo.

SELL OR SWAP—Leeds-Northrup, type "S" resistance testing bridge, tests hundreths of an ohm to 10 megs., excellent; Rider Chanalyst with built-in loudspeaker, excellent. Charles S. Brotzman, 173 Main St., Mexico, Me.

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WANTED—1847 IKE, Ikon tube or any similar tube. E. H. Boden, Lewisberg, Pa.

FOR SALE—Riders' Manuals 16, 17, 18, and 19, top condition, $40. Chuck's Radio, Box 75, Madras, Oregon.

TRADE—Perco F.M. Tuner (built from kit) in good cond. Want 2 or 3 speed record changer or small portable radio. Steve Brannon, 186 Linwood Ave., Providence 7, R. I.

WANTED—Scott SLRF Marine radio set. Also S.P.M8 speaker. T. Lyod Rondeau, 2436 Carney Ave., Marinette, Wis.

FOR SALE OR TRADE—Mark II transmitter-receiver, complete with extras, nearly new. Jackson model 103 tube tester, used 5 months. $45 each or trade for 16mm projector or what have you? Carl Ahlberg, 10256 Springport Rd., Springport, Mich.

SELL OR TRADE—Precision E-200C sig. gen., 90kc through 120mc, used one month, perfect condition. Best offer takes it. L. B. McIntyre, Box 228, Norwood, N. C.

FOR SALE—Precision E-200 sig. gen. Used very little. Make offer or will trade for 8mm movie projector. John O. Bakke, Rt. 1, Box 51A, Oklee, Minn.

FOR SALE—9 assorted 2", 3", 4" meters, $45. John Handzo, Jr., 748 Drake Ave., Roselle, N. J.

FOR SALE—Clough-Brengle, OMA signal gen. with wobbler, $25; Clough-Brengle CRA, scope, $50. Both in good working condition. C. A. Snider, 25 Mt. Airy Ave., Waynesboro, Pa.

SELL OR SWAP—Sprayberry Electronic and Radio Course, complete except kits. Want signal tracer or ohmmeter. A. K. Palmer, 410 So. 17th St., Fort Smith, Ark.

FOR SALE—National 7" TV mahogony cabinet, $75. Martin C. Stutzbach, 80-24 62 Street, Glendale 27, N. Y.

WANTED—40 and 80 meter command receivers, receiver vibrator supply for BC 654, 7 MC and 14 MC bandspread coils for Meissner 9-1080 shifter. Marc Molyneux, Jr., 53 Gulf St., Chickasaw, Ala.

SELL OR SWAP—Superior model 1240 tube checker in good condition. What have you? E. S. Barnett, Republican Grove, Virginia.

FOR SALE—Model 7050 Philco tube tester, used one week. Hickok signal gen. in perfect condition. Both instruments at $50 FOB. Vick Radio Service, P.O. Box 216 Kershaw, S. C.

FOR SALE—Established Radio Sales and Service business. The only one in this city and located in the middle of business district. Full information upon request. Newton C. King, P.O. Box 561, Bonifay, Fla.

FOR SALE—Hallicrafter S38 like new and 110V ac Instructograph, all 10 tapes and oscillator. Want cash or surplus equip. John Morrice, 167 Myrtle Ave., Staten Island 10, New York.

FOR SALE OR TRADE—Precision E-200 signal gen. Make offer or will trade for any good vacuum tube volt-ohmmeter. S. C. Rothgesser, 1845 - 66th St., Brooklyn 4, N. Y.

TRADE—Over 125 Radio Books and Magazines. Want Sprague Tel-ohmike type TO-3, Aerovox 76 or Cornell-Dubilier Model BN capacitor analyzer. J. T. Cookson, Lock Box O, Puxico, Mo.

FOR SALE—Mark II transmitter-receiver, $35; Stancor 10-P, 10 watt fone-CW transmitter with all tubes and 40 meter coil, less crystal, $15. Rev. Louis Wolken, Maryknoll Junior Seminary, Clarks Summit, Pa.

FOR SALE OR TRADE—One Fieler TS-1 signal tracer and one Gimix Wavemeter. Both for $10 or trade for any Rider Manual, except 1 to 5 abridged and 10. Ralph Bianco, 1431 Robinson Ave., Havertown, Pa.

FOR SALE—Electronic design VTVM in good condition. Also latest Precision signal generator model E-200C. Both for $110. Dan Ranier, 1180 Hoe Ave., Bronx 59, N. Y.

FOR SALE OR TRADE—Stock of radio repair shop, parts, tubes, instruments, manuals, tools, etc., $850. Want late 12" or 16" TV chassis with picture tube, snap-in tuner; wire recorder; PA system. Bentleys Radio, Paxton, Ill.

FOR SALE—R. P. Port. tube tester, model 310, $47.50; Silver model 906 sig. gen., $85.50. Also a number of small radios and misc. items. Gregorie Ficara, 15 Furnace Street, Springfield, Vt.

FOR SALE—AEC Geiger Counters, $25. St. George Wire Recorder, $25. Modern Design, East Rockaway, N. Y.

FOR SALE—Victor 16mm sound projector model 40. Mrs. Kathryne Lyding, Box 35 Hartwick, N. Y.

FOR SALE OR TRADE—Breting 12 Communications receiver, 5 bands broadcast to 10 meters. Make an offer. M. Shively, 3115 Ingham St., Lansing 10, Mich.

FOR SALE—RME69-DB20 combination receiver, complete with crystal filter, noise silencer, and built-in monitor. Best reasonable offer. Randolph E. Neal, 713 Spring St. N. W., Atlanta, Ga.

FOR SALE— "Electronic Designs" VTVM model 100, completely wired ready to operate, three test leads included, 5 per cent accuracy, $30. Edward Brehove, 66 Kensington Terrace, Passaic, N. J.

FOR SALE—Howard Sams Photo-facts Sets 1 to 20 inclusive. One No. 450 Superior tube tester. Cheap in price and in good condition. Guy K. Achey, 118 Sioux Avenue, Lebanon, Pa.

WANTED—A good 25B5 tube, in or out of carton, will pay your price. Must have. Warren R. Davee, 246 South Main St., West Point, Nebraska.

WANTED—NRI tube tester or singal tracer. Have Argoflex camera model E and light meter to trade. Vernon Van Nostrand, 1018 Marion Dr., Bay City, Mich.

WANTED—Cabinet for old type Weston Counter model No. 674 tube tester. State price. Francis J. Mc Nulty, 50 A Vernon Street, Worcester 4, Mass.

SWAP—Epsey tube tester; vacuum tube volt-ohm-meter; Precision signal gen. Want Lionel trains. J. Russell, 1437, West 4th St., Plainfield, N. J.

TRADE—Have pair 810's; also R-9'er. Will sell or trade for BC-454 and BC-455 in good condition. A. S. Wilde, 270 Tryon Rd., Bedford, Ohio.

FOR SALE—Revere tape recorder, in original carton that has not been opened. $140 FOB. Milton Kalashian, 2 Congress St., Newburyport, Mass.

FOR SALE—Silver Model 805 Q-5er. Complete with tubes, postpaid for $15. W. M. McDonald, Dadeville, Alabama.

FOR SALE—Radio parts for ham and experimenter. Want "Photo Exact" copying equipment, Keystone projector, overhead recording screws. Harry Kay, Rt. 2, Imlay City, Mich.

SWAP—Jap 25 cal. rifle for a low power fone and CW transmitter. H. L. Evertson, 3234 Sena Dr., Topeka, Kansas.

FOR SALE—C-12 Channel Analyzer, Willard 12V battery, Allstate 10A charger, Sig. Corp. Interphone Amplifier, TU 26 C Transmitter Tuning Unit, old radio mags. and books. Lyle M. Parks, 1701 Elizabeth St., Bay City, Mich.

WANTED—Used Rider Manuals, 4, 6, 7, 9, 10, 11, 12. Price must be reasonable. Martin C. Renny, 12080 Wyoming Ave., Detroit 4, Mich.

FOR SALE—Precision 250 Signal tracer. Incorporates 4 stage vacuum tube voltmeter for visual trouble shooting as well as listen in check. $35. Max M. Finkelstein, 1711 Ocean Parkway, Brooklyn 23, New York.

SWAP OR SELL—50kc. I.F. transformers, Q of 50, powdered iron slugs and shells, for use in super-selective I.F. strips. Want TB-35's 813's, B & W Butterfly tank condenser. G. H. Goldstone, 1745 W. Boston, Detroit 6, Mich.

WANTED—Oscilloscope, CRO-5A General Electric. State price and condition. Edward Jackson, 5007 McKinney Ave., Dallas 5, Texas.

SELL OR SWAP—For radio test equipment, complete 40 meter station, extras. VFO rig, two receivers, etc. R. A. Williams, R1, Box 210A, Redlands, Calif.

FOR SALE—Radio Service Shop, best in equipment including Hickok scope, generator, and traceometer. Complete stock of tubes and parts, also complete set of Riders Manuals. Sheldon Radio, Osage, Iowa

FOR SALE OR TRADE—Tel-O-Aid for amplifying telephone conversations, 8" speaker, 4 watt amplifier, and Inductive pick-up, $15 or what have you? Walton Hershfield, 2334 E. Whitton, Phoenix, Arizona.

FOR SALE—NC 173 receiver, in perfect condition, complete, $140. Walter E. Rosson, 262 W. Mondalay, San Antonio, Texas.

FOR SALE—BC-645 Army radio transmitter-receiver converted to citizens band operation, complete with all tubes and diagrams, no power supply, $25. Need Rider Manuals 7 to 13, pay cash for individual volumes. Radio Service Shop, 130 Broadway, Hornell, N. Y.

WANTED—Gonset 3-30 meter mobile converter, new or used. Have a Weston Master exposure meter to trade as part payment. Louis Pasquare, 9225 93 Ave., Woodhaven 21, N. Y.

FOR SALE—Seeburg 78 rpm record changer, 10-12", 12-10" records. With L-70 crystal and Adapter made by American Microphone Co. of Pas. Calif., for 33½ and 45 rpm, with Micro needle. All for $20. L. Glenn Royce, 120 E. Pamona St., Philadelphia 44, Pa.

WANTED—Complete set of Riders Manuals or any separate volumes. Will pay cash. Harold J. Braun, 2121 Schiller Ave., Wilmette, Illinois.

FOR SALE—Precision signal generator, series E-200 with dummy IRE antenna, servicing by signal substitution. Also Silver model 904 capacitance resistance bridge. Will sell both for $55. George Mezger, 36 Myrtle Ave, Claymont, Del.

FOR SALE—RCA portable wire recorder, perfect running condition, including wire cartridge, $100, or best offer. Joseph Baron, 22 Hancock St., Lynn, Mass.

FOR SALE—Radio repair business, reasonable. Details on request. Crescent Radio Service, 494 Crescent St., Brooklyn 8, N. Y.

FOR SALE OR TRADE—New and Used 110 and 6 volt motors, new 12" jig-saw, electric drill and stand. Want tube tester, signal tracer, code oscillator, solder gun, or what have you? Braun's Radio Service, Bellevue, Ohio.

FOR SALE—Radio City Products model 802NA tube and set tester, complete with roll chart, $40; Heath signal generator, Factory aligned, 150kc to 102mc, $15. Joseph A. Frazier, 8510 Packard Ave., Van Dyke, Mich.

FOR SALE—Television receiver, 52 sq. in. picture, blonde maple, built-in television filter and headphone adaptor, perfect condition, $125. Bill Ryan, 147 Westdale Road, Upper Darby, Pa.

FOR SALE—Precision model 612 tube tester, with papers and instructions, $55. Grant Volsch 907 E. 2nd St., Sioux Falls, So. Dak.

WANTED—Transmitting, special purpose, and receiving type tubes in large or small quantities. Turn your excess into ready cash. B. N. Gensler, 162 Greenwich St., New York 6, N. Y.

FOR SALE—Motorola 401 Auto set, $38. Also Transvision 12" de luxe TV set with cabinet. Make offer. J. Israel, 296 Wainwright St., Newark 8, N. J.

FOR SALE—Used NRI model 1175B tester in fine shape. This is a combination all-wave signal generator and all-purpose multimeter. Norman Nelson, Mahnomen, Minnesota.

SELL OR TRADE—Assorted tubes, many scarce numbers, sell cheap, list upon request. Want surplus gear suitable for citizens band or radio control, and 8mm movie projector. G. Luther, 921 S. Webster, Saginaw, Mich.

FOR SALE—Riders 1 thru 13, and 15, paper bands still around pages in front, $125. Also two Jensen trumpets like new, $22.50 each. Albert Hourigan, Jr., 839 N. 6th St., Vandalia, Illinois.

FOR SALE—2 Astatic model 400 pickup arms with GE cartridges of 1 and 3 mils, $10 each; Pilot FM tuner, $18; Heath 5" oscilloscope, assembled, 5BP4 white CRT, $40. All in good condition. William Engstrom, 35 Battle Road, Princeton, N. J.

FOR SALE—HQ120X with spare tubes, phones and small speaker, $70.; Hammarlund 4-20 xmtr. and 4-11 mod., perfect cond. Spare tubes, Precision crystals (14), coils, manual, mike, $100, F.O.B. John Warner, 14 Macaltioner, Woodstown, N. J.

FOR SALE—Keystone A-82 movie projector, with lens, large screen, 12 400' reels, splicer, etc., fine condition. $100 FOB or best television set offered. H. W. Leeds, 15 West 15 Street, Ocean City, N. J.

SELL OR TRADE—Philco 077 sig. gen., Precision model 910 tubetester, Speco sig. tracer, assorted power transformers. Send offer. V. T. Zdanek, 639 Elm St., Youngstown 2, Ohio

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FOR SALE—7" Transvision TV with magnifier in good shape. Works fine. Make offer. Greiner Radio Service Co., 299 S. Elmwood Ave., Buffalo, N. Y.

TRADE—U. S. Army Engineers pocket compass, Jena telescope, Casey hand grinder with 30 accessories. What have you? John Conroy, 2608 N. 11th St., Philadelphia 33, Pa.

FOR SALE—T-23/ARC-5 transmitter, with tubes, less crystals, $15; Md-7/ARC-5 modulator, with tubes, $10 E. J. Mack, 82 Broadway, Bayonne, N. J.

FOR SALE—Tech Master Blue Ribbon TV, completely assembled, working order, 22 tubes, 10BP4 picture tube, super-ex window ant. plus lead in, $90. Marlin L. Bowser, 777 Huber Street, Johnstown, Pa.

FOR SALE—TV, 7" Viewtone with mahogany cabinet, suitable for amateur TV, $35 or swap for sig. gen. or camera (will pay cash difference on latter). S. Hirsh, 386 Berriman St., Brooklyn 8, N. Y.

SELL OR TRADE—Wurlitzer model 61 juke box (counter), perfect operating, plays 12 records. Want HQ129 or equivalent in trade. Will deliver within 150 miles. Have BC459 manual for BC1284. G. F. Gnandt, Creek Valley Park, Wellington, Ohio.

FOR SALE—Model 400 EC10 oscilloscope used less than 5 hrs., first $30 takes it. D. Creuzberger, 309 Newry St., Hollidaysburg, Pa.

FOR SALE—Riders manual, vol. 18, never used, $14. R. E. Johnson, 3 Washington Pl., Cranford, N. J.

SELL OR TRADE—Pair of TBY's complete except antennas, $40; 3" scope (homemade), $20; Weston model 663 volt ohmmeter, $20; pair of BC-222's Walkie Talkies, $45. Need sig. gen., etc. Gau Radio Service, Box 285, Pierz, Minn.

FOR SALE—Riders, 1-14, $110, perfect; Precision E-200, $40; Precision 920P, $60; Supreme 562, $75. Have others. Write. J. J. Notaris, 115 Butler Ave., Ambler, Pa.

SELL OR SWAP—Dumont oscillograph, model 164, slightly used, $50. Tony Gosik, 8909 Helen Ave., Detroit 11, Mich.

FOR SALE — Ghirardi's Trouble-Shooter Book, case histories, Second Edition, 2.98. Handyman, 25-95 41 St., Astoria 3, N. Y.

FOR SALE—Riders No. 3, Motorola automatic control head for 42 to 48 Chev and Fada No. 795 FM tuner. E. G. Mason, 5 Bayview St., Yarmouth, Me.

SELL OR SWAP—Army aircraft receiver, 454-B, range (converted) 2.3 to 5. meg., with built-in 110v. A.C. power supply, complete except for speaker, $10, plus postage. C. F. Elgasser, Jr., 1920 Fern St., San Diego, Calif.

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